Red Hat Enterprise Linux 5 Global File System

Red Hat Global File System
Edition 4

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Abstract

This book provides information about configuring, and maintaining Red Hat GFS (Red Hat Global File System) for Red Hat Enterprise Linux 5.

Table of Contents

Introduction **4**
1. Audience 4
2. Related Documentation 4
3. Document Conventions 5
3.1. Typographic Conventions 5
3.2. Pull-quote Conventions 6
3.3. Notes and Warnings 7
4. Feedback 7

Chapter 1. GFS Overview **8**
1.1. New and Changed Features 9
1.2. Performance, Scalability, and Economy 9
1.2.1. Superior Performance and Scalability 10
1.2.2. Economy and Performance 10
1.3. GFS Software Components 12
1.4. Before Setting Up GFS 12

Chapter 2. Getting Started **14**
2.1. Prerequisite Tasks 14
2.2. Initial Setup Tasks 14

Chapter 3. Managing GFS **16**
3.1. Creating a File System 16

Usage **17**

Examples **18**

Complete Options **19**
3.2. Mounting a File System 20

Usage **20**

Example **20**

Complete Usage **20**
3.3. Unmounting a File System 23

Usage **23**
3.4. Special Considerations when Mounting GFS File Systems 23
3.5. Displaying GFS Tunable Parameters 23

Usage **24**

Examples **24**
3.6. GFS Quota Management 25
3.6.1. Setting Quotas 25

Usage **25**

Examples **26**
3.6.2. Displaying Quota Limits and Usage 26

Usage **26**

Command Output **27**

Comments **27**

Examples **27**
3.6.3. Synchronizing Quotas 28

Usage **28**

Examples **28**
3.6.4. Disabling/Enabling Quota Enforcement 29

Usage **29**

Comments **29**

Examples **29**
3.6.5. Disabling/Enabling Quota Accounting 30

Usage **30**

Comments **30**

Examples **30**
3.7. Growing a File System 31

Usage **31**

Comments **31**

Examples **32**

Complete Usage **32**
3.8. Adding Journals to a File System 32

Usage **33**

Comments **33**

Examples **34**

Complete Usage **34**
3.9. Direct I/O 35
3.9.1. O_DIRECT 36
3.9.2. GFS File Attribute 36

Usage **36**

Example **36**
3.9.3. GFS Directory Attribute 37

Usage **37**

Example **37**
3.10. Data Journaling 37

Usage **38**

Examples **38**
3.11. Configuring atime Updates 38
3.11.1. Mount with noatime 39

Usage **39**

Example **39**
3.11.2. Tune GFS atime Quantum 39

Usage **40**

Example **40**
3.12. Suspending Activity on a File System 40

Usage **40**

Examples **41**
3.13. Displaying Extended GFS Information and Statistics 41
3.13.1. Displaying GFS Space Usage 41

Usage **41**

Example **41**
3.13.2. Displaying GFS Counters 42

Usage **44**

Example **44**
3.13.3. Displaying Extended Status 45

Usage **45**

Example **45**
3.14. Repairing a File System 46

Usage **47**

Example **48**
3.15. Context-Dependent Path Names 49

Usage **49**

Example **50**
3.16. The GFS Withdraw Function 50

Revision History **52**

Index **53**

Introduction

The *Global File System Configuration and Administration* document provides information about configuring and maintaining Red Hat GFS (Red Hat Global File System). A GFS file system can be implemented in a standalone system or as part of a cluster configuration. For information about Red Hat Cluster Suite refer to *Red Hat Cluster Suite Overview* and *Configuring and Managing a Red Hat Cluster*.

HTML and PDF versions of all the official Red Hat Enterprise Linux manuals and release notes are available online at https://access.redhat.com/site/documentation/en-US/.

1. Audience

This book is intended primarily for Linux system administrators who are familiar with the following activities:

- Linux system administration procedures, including kernel configuration
- Installation and configuration of shared storage networks, such as Fibre Channel SANs

2. Related Documentation

For more information about using Red Hat Enterprise Linux, refer to the following resources:

- *Red Hat Enterprise Linux Installation Guide* — Provides information regarding installation of Red Hat Enterprise Linux 5.
- *Red Hat Enterprise Linux Deployment Guide* — Provides information regarding the deployment, configuration and administration of Red Hat Enterprise Linux 5.

For more information about Red Hat Cluster Suite for Red Hat Enterprise Linux 5, refer to the following resources:

- *Red Hat Cluster Suite Overview* — Provides a high level overview of the Red Hat Cluster Suite.
- *Configuring and Managing a Red Hat Cluster* — Provides information about installing, configuring and managing Red Hat Cluster components.
- *Logical Volume Manager Administration* — Provides a description of the Logical Volume Manager (LVM), including information on running LVM in a clustered environment.
- *Global File System 2: Configuration and Administration* — Provides information about installing, configuring, and maintaining Red Hat GFS2 (Red Hat Global File System 2).
- *Using Device-Mapper Multipath* — Provides information about using the Device-Mapper Multipath feature of Red Hat Enterprise Linux 5.
- *Using GNBD with Global File System* — Provides an overview on using Global Network Block Device (GNBD) with Red Hat GFS.
- *Linux Virtual Server Administration* — Provides information on configuring high-performance systems and services with the Linux Virtual Server (LVS).
- *Red Hat Cluster Suite Release Notes* — Provides information about the current release of Red Hat Cluster Suite.

Red Hat Cluster Suite documentation and other Red Hat documents are available in HTML, PDF, and RPM versions on the Red Hat Enterprise Linux Documentation CD and online at https://access.redhat.com/site/documentation/en-US/.

3. Document Conventions

This manual uses several conventions to highlight certain words and phrases and draw attention to specific pieces of information.

3.1. Typographic Conventions

Four typographic conventions are used to call attention to specific words and phrases. These conventions, and the circumstances they apply to, are as follows.

Mono-spaced Bold

Used to highlight system input, including shell commands, file names and paths. Also used to highlight keys and key combinations. For example:

> To see the contents of the file **my_next_bestselling_novel** in your current working directory, enter the **cat my_next_bestselling_novel** command at the shell prompt and press **Enter** to execute the command.

The above includes a file name, a shell command and a key, all presented in mono-spaced bold and all distinguishable thanks to context.

Key combinations can be distinguished from an individual key by the plus sign that connects each part of a key combination. For example:

> Press **Enter** to execute the command.
>
> Press **Ctrl**+**Alt**+**F2** to switch to a virtual terminal.

The first example highlights a particular key to press. The second example highlights a key combination: a set of three keys pressed simultaneously.

If source code is discussed, class names, methods, functions, variable names and returned values mentioned within a paragraph will be presented as above, in **mono-spaced bold**. For example:

> File-related classes include **filesystem** for file systems, **file** for files, and **dir** for directories. Each class has its own associated set of permissions.

Proportional Bold

This denotes words or phrases encountered on a system, including application names; dialog-box text; labeled buttons; check-box and radio-button labels; menu titles and submenu titles. For example:

> Choose **System** → **Preferences** → **Mouse** from the main menu bar to launch **Mouse Preferences**. In the **Buttons** tab, select the **Left-handed mouse** check box and click **Close** to switch the primary mouse button from the left to the right (making the mouse suitable for use in the left hand).
>
> To insert a special character into a **gedit** file, choose **Applications** → **Accessories** → **Character Map** from the main menu bar. Next, choose **Search** → **Find…** from the **Character Map** menu bar, type the name of the character in the **Search** field and click **Next**. The character you sought will be highlighted in the

> **Character Table**. Double-click this highlighted character to place it in the **Text to copy** field and then click the **Copy** button. Now switch back to your document and choose **Edit** → **Paste** from the **gedit** menu bar.

The above text includes application names; system-wide menu names and items; application-specific menu names; and buttons and text found within a GUI interface, all presented in proportional bold and all distinguishable by context.

Mono-spaced Bold Italic or ***Proportional Bold Italic***

Whether mono-spaced bold or proportional bold, the addition of italics indicates replaceable or variable text. Italics denotes text you do not input literally or displayed text that changes depending on circumstance. For example:

> To connect to a remote machine using ssh, type **ssh *username@domain.name*** at a shell prompt. If the remote machine is **example.com** and your username on that machine is john, type **ssh john@example.com**.
>
> The **mount -o remount *file-system*** command remounts the named file system. For example, to remount the **/home** file system, the command is **mount -o remount /home**.
>
> To see the version of a currently installed package, use the **rpm -q *package*** command. It will return a result as follows: ***package-version-release***.

Note the words in bold italics above: username, domain.name, file-system, package, version and release. Each word is a placeholder, either for text you enter when issuing a command or for text displayed by the system.

Aside from standard usage for presenting the title of a work, italics denotes the first use of a new and important term. For example:

> Publican is a *DocBook* publishing system.

3.2. Pull-quote Conventions

Terminal output and source code listings are set off visually from the surrounding text.

Output sent to a terminal is set in **mono-spaced roman** and presented thus:

```
books        Desktop   documentation  drafts  mss    photos   stuff  svn
books_tests  Desktop1  downloads      images  notes  scripts  svgs
```

Source-code listings are also set in **mono-spaced roman** but add syntax highlighting as follows:

```
static int kvm_vm_ioctl_deassign_device(struct kvm *kvm,
                 struct kvm_assigned_pci_dev *assigned_dev)
{
         int r = 0;
         struct kvm_assigned_dev_kernel *match;

         mutex_lock(&kvm->lock);

         match = kvm_find_assigned_dev(&kvm->arch.assigned_dev_head,
                                       assigned_dev->assigned_dev_id);
         if (!match) {
                 printk(KERN_INFO "%s: device hasn't been assigned before, "
                   "so cannot be deassigned\n", __func__);
                 r = -EINVAL;
```

```
                goto out;
        }

        kvm_deassign_device(kvm, match);

        kvm_free_assigned_device(kvm, match);

out:
        mutex_unlock(&kvm->lock);
        return r;
}
```

3.3. Notes and Warnings

Finally, we use three visual styles to draw attention to information that might otherwise be overlooked.

Note

Notes are tips, shortcuts or alternative approaches to the task at hand. Ignoring a note should have no negative consequences, but you might miss out on a trick that makes your life easier.

Important

Important boxes detail things that are easily missed: configuration changes that only apply to the current session, or services that need restarting before an update will apply. Ignoring a box labeled “Important” will not cause data loss but may cause irritation and frustration.

Warning

Warnings should not be ignored. Ignoring warnings will most likely cause data loss.

4. Feedback

If you spot a typo, or if you have thought of a way to make this manual better, we would love to hear from you. Please submit a report in Bugzilla (http://bugzilla.redhat.com/bugzilla/). File the bug against the product **Red Hat Enterprise Linux 5** and against the component **Documentation-cluster**.

Be sure to mention the manual's identifier:

```
Bugzilla component: Documentation-cluster
Book identifier: Global_File_System(EN)-5 (2014-6-14T15:10)
```

By mentioning this manual's identifier, we know exactly which version of the guide you have.

If you have a suggestion for improving the documentation, try to be as specific as possible. If you have found an error, please include the section number and some of the surrounding text so we can find it easily.

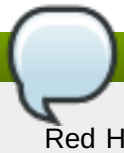
Chapter 1. GFS Overview

The Red Hat GFS file system is a native file system that interfaces directly with the Linux kernel file system interface (VFS layer). When implemented as a cluster file system, GFS employs distributed metadata and multiple journals. Red Hat supports the use of GFS file systems only as implemented in Red Hat Cluster Suite.

Note

Although a GFS file system can be implemented in a standalone system or as part of a cluster configuration, for the Red Hat Enterprise Linux 5.5 release and later Red Hat does not support the use of GFS as a single-node file system. Red Hat does support a number of high-performance single node file systems which are optimized for single node and thus have generally lower overhead than a cluster filesystem. Red Hat recommends using these file systems in preference to GFS in cases where only a single node needs to mount the file system.

Red Hat will continue to support single-node GFS file systems for existing customers.



Note

Red Hat does not support using GFS for cluster file system deployments greater than 16 nodes.

GFS is based on a 64-bit architecture, which can theoretically accommodate an 8 EB file system. However, the current supported maximum size of a GFS file system for 64-bit hardware is 100 TB. The current supported maximum size of a GFS file system for 32-bit hardware is 16 TB. If your system requires larger GFS file systems, contact your Red Hat service representative.

When determining the size of your file system, you should consider your recovery needs. Running the **gfs_fsck** command on a very large file system can take a long time and consume a large amount of memory. Additionally, in the event of a disk or disk-subsytem failure, recovery time is limited by the speed of your backup media. For information on the amount of memory the **gfs_fsck** command requires, see Section 3.14, “Repairing a File System”.

When configured in a Red Hat Cluster Suite, Red Hat GFS nodes can be configured and managed with Red Hat Cluster Suite configuration and management tools. Red Hat GFS then provides data sharing among GFS nodes in a Red Hat cluster, with a single, consistent view of the file system name space across the GFS nodes. This allows processes on different nodes to share GFS files in the same way that processes on the same node can share files on a local file system, with no discernible difference. For information about Red Hat Cluster Suite refer to *Configuring and Managing a Red Hat Cluster*.

While a GFS file system may be used outside of LVM, Red Hat supports only GFS file systems that are created on a CLVM logical volume. CLVM is a cluster-wide implementation of LVM, enabled by the CLVM daemon **clvmd**, which manages LVM logical volumes in a Red Hat Cluster Suite cluster. The daemon makes it possible to use LVM2 to manage logical volumes across a cluster, allowing all nodes in the cluster to share the logical volumes. For information on the LVM volume manager, see *Logical Volume Manager Administration*

Note

When you configure a GFS file system as a cluster file system, you must ensure that all nodes in the cluster have access to the shared file system. Asymmetric cluster configurations in which some nodes have access to the file system and others do not are not supported.

This chapter provides some basic, abbreviated information as background to help you understand GFS. It contains the following sections:

- Section 1.1, “New and Changed Features”
- Section 1.2, “Performance, Scalability, and Economy”
- Section 1.3, “GFS Software Components”
- Section 1.4, “Before Setting Up GFS”

1.1. New and Changed Features

This section lists new and changed features included with the initial release of Red Hat Enterprise Linux 5.

- GULM (Grand Unified Lock Manager) is not supported in Red Hat Enterprise Linux 5. If your GFS file systems use the GULM lock manager, you must convert the file systems to use the DLM lock manager. This is a two-part process.
  - While running Red Hat Enterprise Linux 4, convert your GFS file systems to use the DLM lock manager.
  - Upgrade your operating system to Red Hat Enterprise Linux 5, converting the lock manager to DLM when you do.

  For information on upgrading to Red Hat Enterprise Linux 5 and converting GFS file systems to use the DLM lock manager, see *Configuring and Managing a Red Hat Cluster.*
- Documentation for Red Hat Cluster Suite for Red Hat Enterprise Linux 5 has been expanded and reorganized. For information on the available documents, see Section 2, “Related Documentation”.

1.2. Performance, Scalability, and Economy

You can deploy GFS in a variety of configurations to suit your needs for performance, scalability, and economy. For superior performance and scalability, you can deploy GFS in a cluster that is connected directly to a SAN. For more economical needs, you can deploy GFS in a cluster that is connected to a LAN with servers that use *GNBD* (Global Network Block Device).

The following sections provide examples of how GFS can be deployed to suit your needs for performance, scalability, and economy:

- Section 1.2.1, “Superior Performance and Scalability”
- Section 1.2.2, “Economy and Performance”

Note

The deployment examples in this chapter reflect basic configurations; your needs might require a combination of configurations shown in the examples.

1.2.1. Superior Performance and Scalability

You can obtain the highest shared-file performance when applications access storage directly. The GFS SAN configuration in Figure 1.1, “GFS with a SAN” provides superior file performance for shared files and file systems. Linux applications run directly on GFS nodes. Without file protocols or storage servers to slow data access, performance is similar to individual Linux servers with directly connected storage; yet, each GFS application node has equal access to all data files. GFS supports up to 125 GFS nodes.

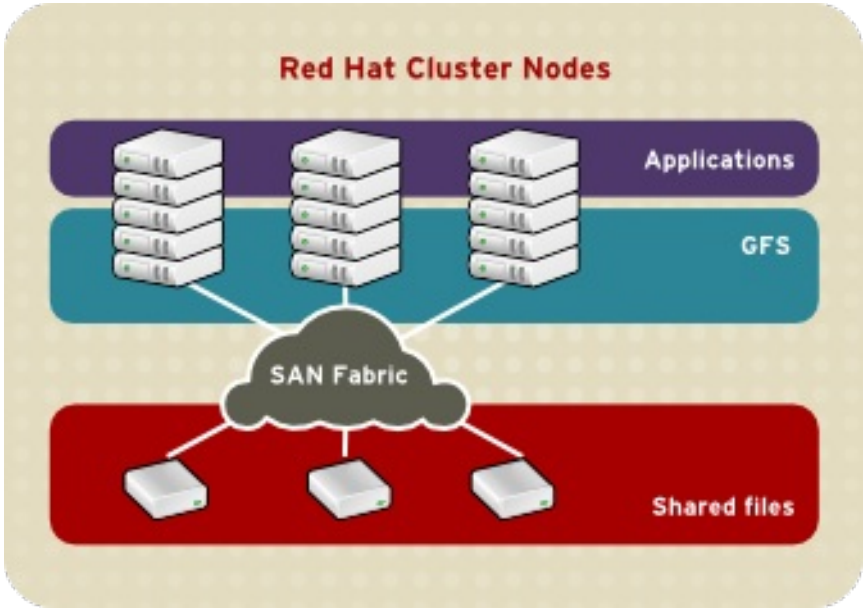


Figure 1.1. GFS with a SAN

1.2.2. Economy and Performance

Multiple Linux client applications on a LAN can share the same SAN-based data as shown in Figure 1.2, “GFS and GNBD with a SAN”. SAN block storage is presented to network clients as block storage devices by GNBD servers. From the perspective of a client application, storage is accessed as if it were directly attached to the server in which the application is running. Stored data is actually on the SAN. Storage devices and data can be equally shared by network client applications. File locking and sharing functions are handled by GFS for each network client.

Note

Clients implementing ext2 and ext3 file systems can be configured to access their own dedicated slice of SAN storage.

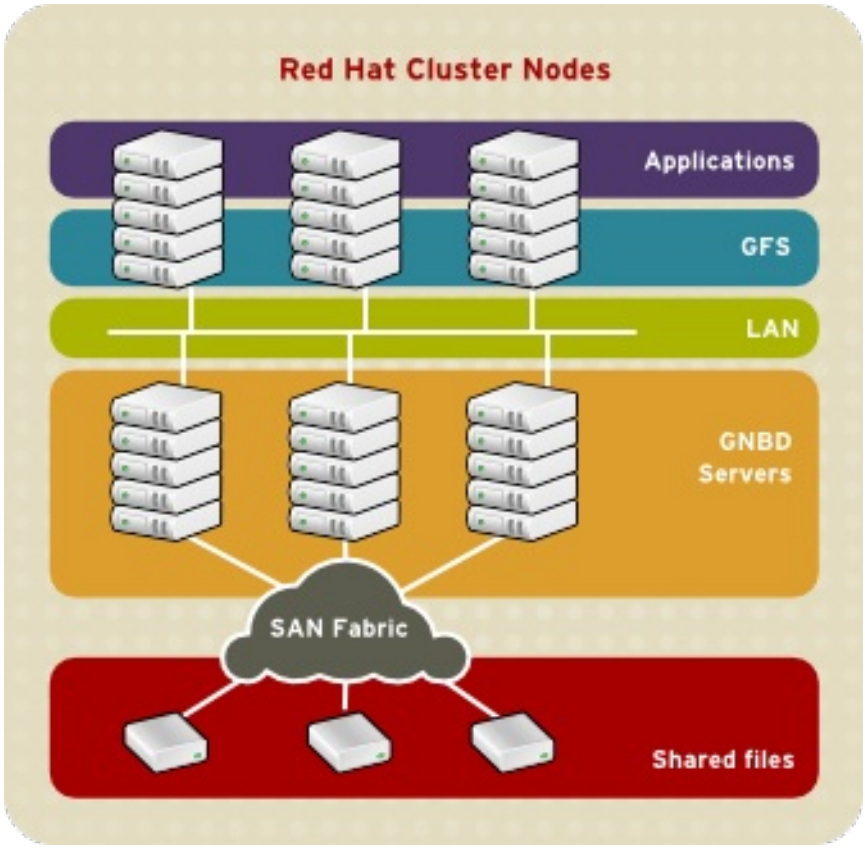


Figure 1.2. GFS and GNBD with a SAN

Figure 1.3, "GFS and GNBD with Directly Connected Storage" shows how Linux client applications can take advantage of an existing Ethernet topology to gain shared access to all block storage devices. Client data files and file systems can be shared with GFS on each client. Application failover can be fully automated with Red Hat Cluster Suite.

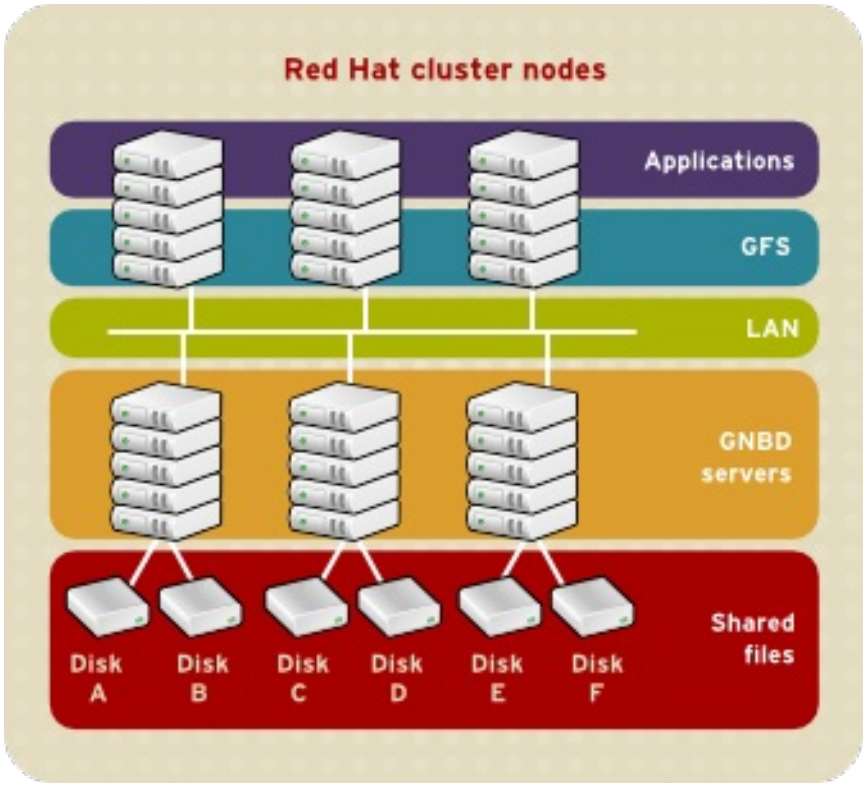


Figure 1.3. GFS and GNBD with Directly Connected Storage

1.3. GFS Software Components

Table 1.1, “GFS Software Subsystem Components” summarizes the GFS software components.

Table 1.1. GFS Software Subsystem Components

Software Component	Description
gfs.ko	Kernel module that implements the GFS file system and is loaded on GFS cluster nodes.
lock_dlm.ko	A lock module that implements DLM locking for GFS. It plugs into the lock harness, **lock_harness.ko** and communicates with the DLM lock manager in Red Hat Cluster Suite.
lock_nolock.ko	A lock module for use when GFS is used as a local file system only. It plugs into the lock harness, **lock_harness.ko** and provides local locking.

1.4. Before Setting Up GFS

Before you install and set up GFS, note the following key characteristics of your GFS file systems:

GFS nodes

Determine which nodes in the Red Hat Cluster Suite will mount the GFS file systems.

Number of file systems

Determine how many GFS file systems to create initially. (More file systems can be added later.)

File system name

Determine a unique name for each file system. Each file system name is required in the form of a parameter variable. For example, this book uses file system names **mydata1** and **mydata2** in some example procedures.

File system size

GFS is based on a 64-bit architecture, which can theoretically accommodate an 8 EB file system. However, the current supported maximum size of a GFS file system for 64-bit hardware is 100 TB. The current supported maximum size of a GFS file system for 32-bit hardware is 16 TB. If your system requires larger GFS file systems, contact your Red Hat service representative.

When determining the size of your file system, you should consider your recovery needs. Running the **gfs_fsck** command on a very large file system can take a long time and consume a large amount of memory. Additionally, in the event of a disk or disk-subsytem failure, recovery time is limited by the speed of your backup media. For information on the amount of memory the **gfs_fsck** command requires, see Section 3.14, “Repairing a File System”.

Journals

Determine the number of journals for your GFS file systems. One journal is required for each node that mounts a GFS file system. Make sure to account for additional journals needed for future expansion, as you cannot add journals dynamically to a GFS file system.

GNBD server nodes

If you are using GNBD, determine how many GNBD server nodes are needed. Note the hostname and IP address of each GNBD server node for setting up GNBD clients later. For information on using GNBD with GFS, see the *Using GNBD with Global File System* document.

Storage devices and partitions

Determine the storage devices and partitions to be used for creating logical volumes (via CLVM) in the file systems.

Note

You may see performance problems with GFS when many create and delete operations are issued from more than one node in the same directory at the same time. If this causes performance problems in your system, you should localize file creation and deletions by a node to directories specific to that node as much as possible.

Chapter 2. Getting Started

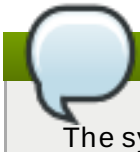
This chapter describes procedures for initial setup of GFS and contains the following sections:

- Section 2.1, “Prerequisite Tasks”
- Section 2.2, “Initial Setup Tasks”

2.1. Prerequisite Tasks

You should complete the following tasks before setting up Red Hat GFS:

- Make sure that you have noted the key characteristics of the GFS nodes (refer to Section 1.4, “Before Setting Up GFS”).
- Make sure that the clocks on the GFS nodes are synchronized. It is recommended that you use the Network Time Protocol (NTP) software provided with your Red Hat Enterprise Linux distribution.



Note

The system clocks in GFS nodes must be within a few minutes of each other to prevent unnecessary inode time-stamp updating. Unnecessary inode time-stamp updating severely impacts cluster performance.

- In order to use GFS in a clustered environment, you must configure your system to use the Clustered Logical Volume Manager (CLVM), a set of clustering extensions to the LVM Logical Volume Manager. In order to use CLVM, the Red Hat Cluster Suite software, including the **clvmd** daemon, must be running. For information on using CLVM, see *Logical Volume Manager Administration*. For information on installing and administering Red Hat Cluster Suite, see *Cluster Administration*.

2.2. Initial Setup Tasks

Initial GFS setup consists of the following tasks:

1. Setting up logical volumes
2. Making a GFS files system
3. Mounting file systems

Follow these steps to set up GFS initially.

1. Using LVM, create a logical volume for each Red Hat GFS file system.

Note

You can use **init.d** scripts included with Red Hat Cluster Suite to automate activating and deactivating logical volumes. For more information about **init.d** scripts, refer to *Configuring and Managing a Red Hat Cluster*.

2. Create GFS file systems on logical volumes created in Step 1. Choose a unique name for each file system. For more information about creating a GFS file system, refer to Section 3.1, “Creating a File System”.

   You can use either of the following formats to create a clustered GFS file system:

   ```
   gfs_mkfs -p lock_dlm -t ClusterName:FSName -j NumberJournals BlockDevice
   ```

   ```
   mkfs -t gfs -p lock_dlm -t LockTableName -j NumberJournals BlockDevice
   ```

   You can use either of the following formats to create a local GFS file system:

   ```
   gfs_mkfs -p lock_nolock -j NumberJournals BlockDevice
   ```

   ```
   mkfs -t gfs -p lock_nolock -j NumberJournals BlockDevice
   ```

   For more information on creating a GFS file system, see Section 3.1, “Creating a File System”.

3. At each node, mount the GFS file systems. For more information about mounting a GFS file system, see Section 3.2, “Mounting a File System”.

   Command usage:

   mount *BlockDevice MountPoint*

   mount -o acl *BlockDevice MountPoint*

   The **-o acl** mount option allows manipulating file ACLs. If a file system is mounted without the **-o acl** mount option, users are allowed to view ACLs (with **getfacl**), but are not allowed to set them (with **setfacl**).

Note

You can use **init.d** scripts included with Red Hat Cluster Suite to automate mounting and unmounting GFS file systems. For more information about **init.d** scripts, refer to *Configuring and Managing a Red Hat Cluster*.

Chapter 3. Managing GFS

This chapter describes the tasks and commands for managing GFS and consists of the following sections:

- Section 3.1, “Creating a File System”
- Section 3.2, “Mounting a File System”
- Section 3.3, “Unmounting a File System”
- Section 3.4, “Special Considerations when Mounting GFS File Systems”
- Section 3.5, “Displaying GFS Tunable Parameters”
- Section 3.6, “GFS Quota Management”
- Section 3.7, “Growing a File System”
- Section 3.8, “Adding Journals to a File System”
- Section 3.9, “Direct I/O”
- Section 3.10, “Data Journaling”
- Section 3.11, “Configuring **atime** Updates”
- Section 3.12, “Suspending Activity on a File System”
- Section 3.13, “Displaying Extended GFS Information and Statistics”
- Section 3.14, “Repairing a File System”
- Section 3.15, “Context-Dependent Path Names”
- Section 3.16, “The GFS Withdraw Function”

3.1. Creating a File System

You can create a GFS file system with the **gfs_mkfs** command. A file system is created on an activated LVM volume. The following information is required to execute the **gfs_mkfs** command:

- Lock protocol/module name. The lock protocol for a cluster is **lock_dlm**. The lock protocol when GFS is acting as a local file system (one node only) is **lock_nolock**.
- Cluster name (when running as part of a cluster configuration).
- Number of journals (one journal required for each node that may be mounting the file systema.) Make sure to account for additional journals needed for future expansion, as you cannot add journals dynamically to a GFS file system.

When creating a GFS file system, you can use the **gfs_mkfs** directly, or you can use the **mkfs** command with the **-t** parameter specifying a file system of type **gfs**, followed by the gfs file system options.

Note

Once you have created a GFS file system with the **gfs_mkfs** command, you cannot decrease the size of the file system. You can, however, increase the size of an existing file system with the **gfs_grow** command, as described in Section 3.7, “Growing a File System”.

Usage

When creating a clustered GFS file system, you can use either of the following formats:

```
gfs_mkfs -p LockProtoName -t LockTableName -j NumberJournals BlockDevice
```

```
mkfs -t gfs -p LockProtoName -t LockTableName -j NumberJournals BlockDevice
```

When creating a local file system, you can use either of the following formats:

Note

For the Red Hat Enterprise Linux 5.5 release and later Red Hat does not support the use of GFS as a single-node file system. Red Hat will continue to support single-node GFS file systems for existing customers.

```
gfs_mkfs -p LockProtoName -j NumberJournals BlockDevice
```

```
mkfs -t gfs -p LockProtoName -j NumberJournals BlockDevice
```

Warning

Make sure that you are very familiar with using the ***LockProtoName*** and ***LockTableName*** parameters. Improper use of the ***LockProtoName*** and ***LockTableName*** parameters may cause file system or lock space corruption.

LockProtoName

Specifies the name of the locking protocol to use. The lock protocol for a cluster is **lock_dlm**. The lock protocol when GFS is acting as a local file system (one node only) is **lock_nolock**.

LockTableName

This parameter is specified for GFS file system in a cluster configuration. It has two parts separated by a colon (no spaces) as follows: ***ClusterName:FSName***

- ***ClusterName***, the name of the Red Hat cluster for which the GFS file system is being created.

- ***FSName***, the file system name, can be 1 to 16 characters long, and the name must be unique among all file systems in the cluster.

NumberJournals

Specifies the number of journals to be created by the **gfs_mkfs** command. One journal is required for each node that mounts the file system. (More journals than are needed can be specified at creation time to allow for future expansion.)

BlockDevice

Specifies a volume.

Examples

In these examples, **lock_dlm** is the locking protocol that the file system uses, since this is a clustered file system. The cluster name is **alpha**, and the file system name is **mydata1**. The file system contains eight journals and is created on **/dev/vg01/lvol0**.

```
[root@ask-07 ~]#  gfs_mkfs -p lock_dlm -t alpha:mydata1 -j 8 /dev/vg01/lvol0
This will destroy any data on /dev/vg01/lvol0.

Are you sure you want to proceed? [y/n] y

Device:                    /dev/vg01/lvol0
Blocksize:                 4096
Filesystem Size:           136380192
Journals:                  8
Resource Groups:           2082
Locking Protocol:          lock_dlm
Lock Table:                alpha:mydata1

Syncing...
All Done
```

```
[root@ask-07 ~]#  mkfs -t gfs -p lock_dlm -t alpha:mydata1 -j 8 /dev/vg01/lvol0
This will destroy any data on /dev/vg01/lvol0.

Are you sure you want to proceed? [y/n] y

Device:                    /dev/vg01/lvol0
Blocksize:                 4096
Filesystem Size:           136380192
Journals:                  8
Resource Groups:           2082
Locking Protocol:          lock_dlm
Lock Table:                alpha:mydata1

Syncing...
All Done
```

In these examples, a second **lock_dlm** file system is made, which can be used in cluster **alpha**. The file system name is **mydata2**. The file system contains eight journals and is created on **/dev/vg01/lvol1**.

```
gfs_mkfs -p lock_dlm -t alpha:mydata2 -j 8 /dev/vg01/lvol1
```

```
mkfs -t gfs -p lock_dlm -t alpha:mydata2 -j 8 /dev/vg01/lvol1
```

Complete Options

Table 3.1, "Command Options: **gfs_mkfs**" describes the **gfs_mkfs** command options.

Table 3.1. Command Options: gfs_mkfs

Flag	Parameter	Description
-b	***BlockSize***	Sets the file system block size to ***BlockSize***. Default block size is 4096 bytes.
-D		Enables debugging output.
-h		Help. Displays available options.
-J	***MegaBytes***	Specifies the size of the journal in megabytes. Default journal size is 128 megabytes. The minimum size is 32 megabytes.
-j	***Number***	Specifies the number of journals to be created by the **gfs_mkfs** command. One journal is required for each node that mounts the file system. **Note:** More journals than are needed can be specified at creation time to allow for future expansion.
-p	***LockProtoName***	Specifies the name of the locking protocol to use. Recognized locking protocols include: **lock_dlm** — The standard locking module, required for a clustered file system. **lock_nolock** — Used when GFS is acting as a local file system (one node only).
-O		Prevents the **gfs_mkfs** command from asking for confirmation before writing the file system.
-q		Quiet. Do not display anything.
-r	***MegaBytes***	Specifies the size of the resource groups in megabytes. Default resource group size is 256 megabytes.
-s	***Blocks***	Specifies the journal-segment size in file system blocks.
-t	***LockTableName***	Used in a clustered file system. This parameter has two parts separated by a colon (no spaces) as follows: ***ClusterName:FSName***. ***ClusterName*** is the name of the Red Hat cluster for which the GFS file system is being created. The cluster name is set in the **/etc/cluster/cluster.conf** file via the **Cluster Configuration Tool** and displayed at the **Cluster Status Tool** in the Red Hat Cluster Suite cluster management GUI. ***FSName***, the file system name, can be 1 to 16 characters in length, and the name must be unique among all file systems in the cluster.
-V		Displays command version information.

3.2. Mounting a File System

Before you can mount a GFS file system, the file system must exist (refer to Section 3.1, “Creating a File System”), the volume where the file system exists must be activated, and the supporting clustering and locking systems must be started (refer to Chapter 2, *Getting Started* and *Configuring and Managing a Red Hat Cluster*. After those requirements have been met, you can mount the GFS file system as you would any Linux file system.

To manipulate file ACLs, you must mount the file system with the **-o acl** mount option. If a file system is mounted without the **-o acl** mount option, users are allowed to view ACLs (with **getfacl**), but are not allowed to set them (with **setfacl**).

Usage

Mounting Without ACL Manipulation

```
mount BlockDevice MountPoint
```

Mounting With ACL Manipulation

```
mount -o acl BlockDevice MountPoint
```

-o acl

GFS-specific option to allow manipulating file ACLs.

BlockDevice

Specifies the block device where the GFS file system resides.

MountPoint

Specifies the directory where the GFS file system should be mounted.

Example

In this example, the GFS file system on **/dev/vg01/lvol0** is mounted on the **/mydata1** directory.

```
mount /dev/vg01/lvol0 /mydata1
```

Complete Usage

```
mount BlockDevice MountPoint -o option
```

The **-o option** argument consists of GFS-specific options (refer to Table 3.2, “GFS-Specific Mount Options”) or acceptable standard Linux **mount -o** options, or a combination of both. Multiple ***option*** parameters are separated by a comma and no spaces.

Note

The **mount** command is a Linux system command. In addition to using GFS-specific options described in this section, you can use other, standard, **mount** command options (for example, **-r**). For information about other Linux **mount** command options, see the Linux **mount** man page.

Table 3.2, "GFS-Specific Mount Options" describes the available GFS-specific **-o option** values that can be passed to GFS at mount time.

Note

This table includes descriptions of options that are used with local file systems only For the Red Hat Enterprise Linux 5.5 release and later Red Hat does not support the use of GFS as a single-node file system. Red Hat will continue to support single-node GFS file systems for existing customers.

Table 3.2. GFS-Specific Mount Options

Option	Description
acl	Allows manipulating file ACLs. If a file system is mounted without the **acl** mount option, users are allowed to view ACLs (with **getfacl**), but are not allowed to set them (with **setfacl**).
ignore_local_fs **Caution:** This option should *not* be used when GFS file systems are shared.	Forces GFS to treat the file system as a multihost file system. By default, using **lock_nolock** automatically turns on the **localcaching** and **localflocks** flags.
localcaching **Caution:** This option should not be used when GFS file systems are shared.	Tells GFS that it is running as a local file system. GFS can then turn on selected optimization capabilities that are not available when running in cluster mode. The **localcaching** flag is automatically turned on by **lock_nolock**.

Option	Description
localflocks **Caution:** This option should not be used when GFS file systems are shared.	Tells GFS to let the VFS (virtual file system) layer do all flock and fcntl. The **localflocks** flag is automatically turned on by **lock_nolock**. Note that the **localflocks** mount option affects only advisory **fcntl()**/POSIX locks and **flock** locks that are issued by applications. The internal locking that ensures coherency of data across the cluster by means of GFS's **glock** abstraction is separate from and not affected by the **localflocks** setting. If you are unsure whether an application uses **fcntl()**/POSIX locks and thus requires that you mount your file system with the **localflocks**, you can use the **strace** utility to print out the system calls that are made during a test run of the application. Look for **fcntl** calls that have **F_GETLK**, **F_SETLK**, or **F_SETLKW** as the **cmd** argument. Note that GFS does not currently support either leases or mandatory locking.
lockproto=*LockModuleName*	Allows the user to specify which locking protocol to use with the file system. If ***LockModuleName*** is not specified, the locking protocol name is read from the file system superblock.
locktable=*LockTableName*	For a clustered file system, allows the user to specify which locking table to use with the file system.
oopses_ok	This option allows a GFS node to *not* panic when an oops occurs. (By default, a GFS node panics when an oops occurs, causing the file system used by that node to stall for other GFS nodes.) A GFS node *not* panicking when an oops occurs minimizes the failure on other GFS nodes using the file system that the failed node is using. There may be circumstances where you do not want to use this option — for example, when you need more detailed troubleshooting information. Use this option with care. **Note:** This option is turned on automatically if **lock_nolock** locking is specified; however, you can override it by using the **ignore_local_fs** option.
upgrade	Upgrade the on-disk format of the file system so that it can be used by newer versions of GFS.

Option	Description
errors=panic|withdraw	When **errors=panic** is specified, file system errors will cause a kernel panic. The default behavior, which is the same as specifying **errors=withdraw**, is for the system to withdraw from the file system and make it inaccessible until the next reboot; in some cases the system may remain running. For information on the GFS withdraw function, see Section 3.16, "The GFS Withdraw Function".

3.3. Unmounting a File System

The GFS file system can be unmounted the same way as any Linux file system — by using the **umount** command.

Note

The **umount** command is a Linux system command. Information about this command can be found in the Linux **umount** command man pages.

Usage

```
umount MountPoint
```

MountPoint

Specifies the directory where the GFS file system should be mounted.

3.4. Special Considerations when Mounting GFS File Systems

GFS file systems that have been mounted manually rather than automatically through an entry in the **fstab** file will not be known to the system when file systems are unmounted at system shutdown. As a result, the GFS script will not unmount the GFS file system. After the GFS shutdown script is run, the standard shutdown process kills off all remaining user processes, including the cluster infrastructure, and tries to unmount the file system. This unmount will fail without the cluster infrastructure and the system will hang.

To prevent the system from hanging when the GFS file systems are unmounted, you should do one of the following:

- Always use an entry in the **fstab** file to mount the GFS file system.
- If a GFS file system has been mounted manually with the **mount** command, be sure to unmount the file system manually with the **umount** command before rebooting or shutting down the system.

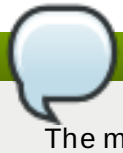
If your file system hangs while it is being unmounted during system shutdown under these circumstances, perform a hardware reboot. It is unlikely that any data will be lost since the file system is synced earlier in the shutdown process.

3.5. Displaying GFS Tunable Parameters

3.5. Displaying GFS Tunable Parameters

There are a variety of parameters associated with a GFS file system that you can modify with the **gfs_tool settune** command. Some of these parameters are used to administer GFS quotas: **quota_quantum**, **quota_enforce**, **quota_account**, and **atime_quantum**. These parameters are described in Section 3.6, "GFS Quota Management", along with examples of how to modify them.

Parameters that you set with the **gfs_tool settune** command must be set on each node each time the file system is mounted. These parameters are not persistent across mounts.



Note

The majority of the tunable parameters are internal parameters. They are intended for development purposes only and should not be changed.

The **gfs_tool gettune** command displays a listing of the current values of the GFS tunable parameters.

Usage

Display Tunable Parameters

```
gfs_tool gettune MountPoint
```

MountPoint

Specifies the directory where the GFS file system is mounted.

Examples

In this example, all GFS tunable parameters for the file system on the mount point **/mnt/gfs** are displayed.

```
[root@tng3-1]# gfs_tool gettune /mnt/gfs
ilimit1 = 100
ilimit1_tries = 3
ilimit1_min = 1
ilimit2 = 500
ilimit2_tries = 10
ilimit2_min = 3
demote_secs = 300
incore_log_blocks = 1024
jindex_refresh_secs = 60
depend_secs = 60
scand_secs = 5
recoverd_secs = 60
logd_secs = 1
quotad_secs = 5
inoded_secs = 15
glock_purge = 0
quota_simul_sync = 64
quota_warn_period = 10
atime_quantum = 3600
quota_quantum = 60
```

```
quota_scale = 1.0000   (1, 1)
quota_enforce = 1
quota_account = 1
new_files_jdata = 0
new_files_directio = 0
max_atomic_write = 4194304
max_readahead = 262144
lockdump_size = 131072
stall_secs = 600
complain_secs = 10
reclaim_limit = 5000
entries_per_readdir = 32
prefetch_secs = 10
statfs_slots = 64
max_mhc = 10000
greedy_default = 100
greedy_quantum = 25
greedy_max = 250
rgrp_try_threshold = 100
statfs_fast = 0
```

3.6. GFS Quota Management

File-system quotas are used to limit the amount of file system space a user or group can use. A user or group does not have a quota limit until one is set. GFS keeps track of the space used by each user and group even when there are no limits in place. GFS updates quota information in a transactional way so system crashes do not require quota usages to be reconstructed.

To prevent a performance slowdown, a GFS node synchronizes updates to the quota file only periodically. The "fuzzy" quota accounting can allow users or groups to slightly exceed the set limit. To minimize this, GFS dynamically reduces the synchronization period as a "hard" quota limit is approached.

GFS uses its **gfs_quota** command to manage quotas. Other Linux quota facilities cannot be used with GFS.

3.6.1. Setting Quotas

Two quota settings are available for each user ID (UID) or group ID (GID): a *hard limit* and a *warn limit*.

A hard limit is the amount of space that can be used. The file system will not let the user or group use more than that amount of disk space. A hard limit value of *zero* means that no limit is enforced.

A warn limit is usually a value less than the hard limit. The file system will notify the user or group when the warn limit is reached to warn them of the amount of space they are using. A warn limit value of *zero* means that no limit is enforced.

Limits are set using the **gfs_quota** command. The command only needs to be run on a single node where GFS is mounted.

Usage

Setting Quotas, Hard Limit

```
gfs_quota limit -u User -l Size -f MountPoint
```

```
gfs_quota limit -g Group -l Size -f MountPoint
```

Setting Quotas, Warn Limit

```
gfs_quota warn -u User -l Size -f MountPoint
```

```
gfs_quota warn -g Group -l Size -f MountPoint
```

User

A user ID to limit or warn. It can be either a user name from the password file or the UID number.

Group

A group ID to limit or warn. It can be either a group name from the group file or the GID number.

Size

Specifies the new value to limit or warn. By default, the value is in units of megabytes. The additional **-k**, **-s** and **-b** flags change the units to kilobytes, sectors, and file system blocks, respectively.

MountPoint

Specifies the GFS file system to which the actions apply.

Examples

This example sets the hard limit for user *Bert* to 1024 megabytes (1 gigabyte) on file system **/gfs**.

```
gfs_quota limit -u Bert -l 1024 -f /gfs
```

This example sets the warn limit for group ID 21 to 50 kilobytes on file system **/gfs**.

```
gfs_quota warn -g 21 -l 50 -k -f /gfs
```

3.6.2. Displaying Quota Limits and Usage

Quota limits and current usage can be displayed for a specific user or group using the **gfs_quota get** command. The entire contents of the quota file can also be displayed using the **gfs_quota list** command, in which case all IDs with a non-zero hard limit, warn limit, or value are listed.

Usage

Displaying Quota Limits for a User

```
gfs_quota get -u User -f MountPoint
```

Displaying Quota Limits for a Group

```
gfs_quota get -g Group -f MountPoint
```

Displaying Entire Quota File

```
gfs_quota list -f MountPoint
```

User

A user ID to display information about a specific user. It can be either a user name from the password file or the UID number.

Group

A group ID to display information about a specific group. It can be either a group name from the group file or the GID number.

MountPoint

Specifies the GFS file system to which the actions apply.

Command Output

GFS quota information from the **gfs_quota** command is displayed as follows:

```
user User: limit:LimitSize warn:WarnSize value:Value

group Group: limit:LimitSize warn:WarnSize value:Value
```

The ***LimitSize***, ***WarnSize***, and ***Value*** numbers (values) are in units of megabytes by default. Adding the **-k**, **-s**, or **-b** flags to the command line change the units to kilobytes, sectors, or file system blocks, respectively.

User

A user name or ID to which the data is associated.

Group

A group name or ID to which the data is associated.

LimitSize

The hard limit set for the user or group. This value is zero if no limit has been set.

Value

The actual amount of disk space used by the user or group.

Comments

When displaying quota information, the **gfs_quota** command does not resolve UIDs and GIDs into names if the **-n** option is added to the command line.

Space allocated to GFS's hidden files can be left out of displayed values for the root UID and GID by adding the **-d** option to the command line. This is useful when trying to match the numbers from **gfs_quota** with the results of a **du** command.

Examples

This example displays quota information for all users and groups that have a limit set or are using any disk space on file system **/gfs**.

```
[root@ask-07 ~]# gfs_quota list -f /gfs
user        root:  limit: 0.0        warn: 0.0        value: 0.2
user         moe:  limit: 1024.0     warn: 0.0        value: 0.0
group       root:  limit: 0.0        warn: 0.0        value: 0.2
group    stooges:  limit: 0.0        warn: 0.0        value: 0.0
```

This example displays quota information in sectors for group **users** on file system **/gfs**.

```
[root@ask-07 ~]# gfs_quota get -g users -f /gfs -s
group    users:  limit: 0          warn: 96         value: 0
```

3.6.3. Synchronizing Quotas

GFS stores all quota information in its own internal file on disk. A GFS node does not update this quota file for every file system write; rather, it updates the quota file once every 60 seconds. This is necessary to avoid contention among nodes writing to the quota file, which would cause a slowdown in performance.

As a user or group approaches their quota limit, GFS dynamically reduces the time between its quota-file updates to prevent the limit from being exceeded. The normal time period between quota synchronizations is a tunable parameter, **quota_quantum**, and can be changed using the **gfs_tool** command. By default, the time period is 60 seconds. Also, the **quota_quantum** parameter must be set on each node and each time the file system is mounted. (Changes to the **quota_quantum** parameter are not persistent across unmounts.)

To see the current values of the GFS tunable parameters, including **quota_quantum**, you can use the **gfs_tool gettune**, as described in Section 3.5, “Displaying GFS Tunable Parameters”.

You can use the **gfs_quota sync** command to synchronize the quota information from a node to the on-disk quota file between the automatic updates performed by GFS.

Usage

Synchronizing Quota Information

```
gfs_quota sync -f MountPoint
```

MountPoint

Specifies the GFS file system to which the actions apply.

Tuning the Time Between Synchronizations

```
gfs_tool settune MountPoint quota_quantum Seconds
```

MountPoint

Specifies the GFS file system to which the actions apply.

Seconds

Specifies the new time period between regular quota-file synchronizations by GFS. Smaller values may increase contention and slow down performance.

Examples

This example synchronizes the quota information from the node it is run on to file system **/gfs**.

```
gfs_quota sync -f /gfs
```

This example changes the default time period between regular quota-file updates to one hour (3600 seconds) for file system **/gfs** on a single node.

```
gfs_tool settune /gfs quota_quantum 3600
```

3.6.4. Disabling/Enabling Quota Enforcement

Enforcement of quotas can be disabled for a file system without clearing the limits set for all users and groups. Enforcement can also be enabled. Disabling and enabling of quota enforcement is done by changing a tunable parameter, **quota_enforce**, with the **gfs_tool** command. The **quota_enforce** parameter must be disabled or enabled on each node where quota enforcement should be disabled/enabled. Each time the file system is mounted, enforcement is enabled by default. (Disabling is not persistent across unmounts.)

To see the current values of the GFS tunable parameters, including **quota_enforce**, you can use the **gfs_tool gettune**, as described in Section 3.5, “Displaying GFS Tunable Parameters”.

Usage

```
gfs_tool settune MountPoint quota_enforce {0|1}
```

MountPoint

Specifies the GFS file system to which the actions apply.

quota_enforce {0|1}

0 = disabled

1 = enabled

Comments

A value of 0 disables enforcement. Enforcement can be enabled by running the command with a value of 1 (instead of 0) as the final command line parameter. Even when GFS is not enforcing quotas, it still keeps track of the file system usage for all users and groups so that quota-usage information does not require rebuilding after re-enabling quotas.

Examples

This example *disables* quota enforcement on file system **/gfs**.

```
gfs_tool settune /gfs quota_enforce 0
```

This example *enables* quota enforcement on file system **/gfs**.

```
gfs_tool settune /gfs quota_enforce 1
```

3.6.5. Disabling/Enabling Quota Accounting

By default, quota accounting is enabled; therefore, GFS keeps track of disk usage for every user and group even when no quota limits have been set. Quota accounting incurs unnecessary overhead if quotas are not used. You can disable quota accounting completely by setting the **quota_account** tunable parameter to 0. This must be done on each node and after each mount. (The 0 setting is not persistent across unmounts.) Quota accounting can be enabled by setting the **quota_account** tunable parameter to 1.

To see the current values of the GFS tunable parameters, including **quota_account**, you can use the **gfs_tool gettune**, as described in Section 3.5, “Displaying GFS Tunable Parameters”.

Usage

```
gfs_tool settune MountPoint quota_account {0|1}
```

MountPoint

Specifies the GFS file system to which the actions apply.

quota_account {0|1}

0 = disabled

1 = enabled

Comments

To enable quota accounting on a file system, the **quota_account** parameter must be set back to 1. Afterward, the GFS quota file must be initialized to account for all current disk usage for users and groups on the file system. The quota file is initialized by running: **gfs_quota init -f *MountPoint***.

Note

Initializing the quota file requires scanning the entire file system and may take a long time.

To see the current values of the GFS tunable parameters, including **quota_account**, you can use the **gfs_tool gettune**, as described in Section 3.5, "Displaying GFS Tunable Parameters".

Examples

This example *disables* quota accounting on file system **/gfs** on a single node.

```
gfs_tool settune /gfs quota_account 0
```

This example enables quota accounting on file system **/gfs** on a single node and initializes the quota file.

```
# gfs_tool settune /gfs quota_account 1
# gfs_quota init -f /gfs
```

3.7. Growing a File System

The **gfs_grow** command is used to expand a GFS file system after the device where the file system resides has been expanded. Running a **gfs_grow** command on an existing GFS file system fills all spare space between the current end of the file system and the end of the device with a newly initialized GFS file system extension. When the fill operation is completed, the resource index for the file system is updated. All nodes in the cluster can then use the extra storage space that has been added.

The **gfs_grow** command must be run on a mounted file system, but only needs to be run on one node in a cluster. All the other nodes sense that the expansion has occurred and automatically start using the new space.

To verify that the changes were successful, use the **gfs_grow** command with the **-T** (test) and **-v** (verbose) flags. Running the command with those flags displays the current state of the mounted GFS file system.

Note

Once you have created a GFS file system with the **gfs_mkfs** command, you cannot decrease the size of the file system.

Usage

```
gfs_grow MountPoint
```

MountPoint

Specifies the GFS file system to which the actions apply.

Comments

Before running the **gfs_grow** command:

- Back up important data on the file system.
- Display the volume that is used by the file system to be expanded by running a **df *MountPoint*** command.
- Expand the underlying cluster volume with LVM. For information on administering LVM volumes, see *Logical Volume Manager Administration*.

The **gfs_grow** command provides a **-T** (test) option that allows you to see the results of executing the command without actually expanding the file system. Using this command with the **-v** provides additional information.

After running the **gfs_grow** command, you can run a **df *MountPoint*** command on the file system to check that the new space is now available in the file system.

Examples

In this example, the underlying logical volume for the file system file system on the **/mnt/gfs** directory is extended, and then the file system is expanded.

```
[root@tng3-1 ~]# lvextend -L35G /dev/gfsvg/gfslv
  Extending logical volume gfslv to 35.00 GB
  Logical volume gfslv successfully resized
[root@tng3-1 ~]# gfs_grow /mnt/gfs
FS: Mount Point: /mnt/gfs
FS: Device: /dev/mapper/gfsvg-gfslv
FS: Options: rw,hostdata=jid=0:id=196609:first=1
FS: Size: 5341168
DEV: Size: 9175040
Preparing to write new FS information...
Done.
```

Complete Usage

```
gfs_grow [Options] {MountPoint | Device} [MountPoint | Device]
```

MountPoint

Specifies the directory where the GFS file system is mounted.

Device

Specifies the device node of the file system.

Table 3.3, “GFS-specific Options Available While Expanding A File System” describes the GFS-specific options that can be used while expanding a GFS file system.

Table 3.3. GFS-specific Options Available While Expanding A File System

Option	Description
-h	Help. Displays a short usage message.
-q	Quiet. Turns down the verbosity level.
-T	Test. Do all calculations, but do not write any data to the disk and do not expand the file system.
-V	Displays command version information.
-v	Turns up the verbosity of messages.

3.8. Adding Journals to a File System

The **gfs_jadd** command is used to add journals to a GFS file system after the device where the file system resides has been expanded. Running a **gfs_jadd** command on a GFS file system uses space between the current end of the file system and the end of the device where the file system resides. When the fill operation is completed, the journal index is updated.

The **gfs_jadd** command must be run on mounted file system, but it only needs to be run on one node in the cluster. All the other nodes sense that the expansion has occurred.

To verify that the changes were successful, use the **gfs_jadd** command with the **-T** (test) and **-v** (verbose) flags. Running the command with those flags displays the current state of the mounted GFS file system.

Usage

```
gfs_jadd -j Number MountPoint
```

Number

Specifies the number of new journals to be added.

MountPoint

Specifies the directory where the GFS file system is mounted.

Comments

Before running the **gfs_jadd** command:

- Back up important data on the file system.
- Run a **df *MountPoint*** command to display the volume used by the file system where journals will be added.
- Expand the underlying cluster volume with LVM. For information on administering LVM volumes, see the *LVM Administrator's Guide*

You can find out how many journals are currently used by the file system with the **gfs_tool df *MountPoint*** command. In the following example, the file system mounted at **/mnt/gfs** uses 8 journals.

```
[root@tng3-1 gfs]# gfs_tool df /mnt/gfs
/mnt/gfs:
  SB lock proto = "lock_dlm"
  SB lock table = "tng3-cluster:mydata1"
  SB ondisk format = 1309
  SB multihost format = 1401
  Block size = 4096
  Journals = 8
  Resource Groups = 76
  Mounted lock proto = "lock_dlm"
  Mounted lock table = "tng3-cluster:mydata1"
  Mounted host data = "jid=0:id=196609:first=1"
  Journal number = 0
  Lock module flags = 0
  Local flocks = FALSE
  Local caching = FALSE
  Oopses OK = FALSE

  Type           Total          Used           Free           use%
  ------------------------------------------------------------------------
  inodes         33             33             0              100%
  metadata       38             2              36             5%
  data           4980077        178            4979899        0%
```

After running the **gfs_jadd** command, you can run the **gfs_tool df *MountPoint*** command again to check that the new journals have been added to the file system.

Examples

In this example, one journal is added to the file system that is mounted at the **/mnt/gfs** directory. The underlying logical volume for this file system is extended before the journal can be added.

```
[root@tng3-1 ~]# lvextend -L35G /dev/gfsvg/gfslv
  Extending logical volume gfslv to 35.00 GB
  Logical volume gfslv successfully resized
[root@tng3-1 ~]# gfs_jadd -j1 /mnt/gfs
FS: Mount Point: /mnt/gfs
FS: Device: /dev/mapper/gfsvg-gfslv
FS: Options: rw,hostdata=jid=0:id=196609:first=1
FS: Size: 5242877
DEV: Size: 9175040
Preparing to write new FS information...
Done.
```

In this example, two journals are added to the file system on the **/mnt/gfs** directory.

```
[root@tng3-1 ~]# gfs_jadd -j2 /mnt/gfs
FS: Mount Point: /mnt/gfs
FS: Device: /dev/mapper/gfsvg-gfslv
FS: Options: rw,hostdata=jid=0:id=196609:first=1
FS: Size: 5275632
DEV: Size: 9175040
Preparing to write new FS information...
Done.
```

Complete Usage

```
gfs_jadd [Options] {MountPoint | Device} [MountPoint | Device]
```

MountPoint

Specifies the directory where the GFS file system is mounted.

Device

Specifies the device node of the file system.

Table 3.4, "GFS-specific Options Available When Adding Journals" describes the GFS-specific options that can be used when adding journals to a GFS file system.

Table 3.4. GFS-specific Options Available When Adding Journals

Flag	Parameter	Description
-h		Help. Displays short usage message.
-J	***MegaBytes***	Specifies the size of the new journals in megabytes. Default journal size is 128 megabytes. The minimum size is 32 megabytes. To add journals of different sizes to the file system, the **gfs_jadd** command must be run for each size journal. The size specified is rounded down so that it is a multiple of the journal-segment size that was specified when the file system was created.
-j	***Number***	Specifies the number of new journals to be added by the **gfs_jadd** command. The default value is 1.
-T		Test. Do all calculations, but do not write any data to the disk and do not add journals to the file system. Enabling this flag helps discover what the **gfs_jadd** command would have done if it were run without this flag. Using the **-v** flag with the **-T** flag turns up the verbosity level to display more information.
-q		Quiet. Turns down the verbosity level.
-V		Displays command version information.
-v		Turns up the verbosity of messages.

3.9. Direct I/O

Direct I/O is a feature of the file system whereby file reads and writes go directly from the applications to the storage device, bypassing the operating system read and write caches. Direct I/O is used only by applications (such as databases) that manage their own caches.

An application invokes direct I/O by opening a file with the **O_DIRECT** flag. Alternatively, GFS can attach a direct I/O attribute to a file, in which case direct I/O is used regardless of how the file is opened.

When a file is opened with **O_DIRECT**, or when a GFS direct I/O attribute is attached to a file, all I/O operations must be done in block-size multiples of 512 bytes. The memory being read from or written to must also be 512-byte aligned.

Note

Performing I/O through a memory mapping and also via direct I/O to the same file at the same time may result in the direct I/O being failed with an I/O error. This occurs because the page invalidation required for the direct I/O can race with a page fault generated through the mapping. This is a problem only when the memory mapped I/O and the direct I/O are both performed on the same node as each other, and to the same file at the same point in time. A workaround is to use file locking to ensure that memory mapped (i.e., page faults) and direct I/O do not occur simultaneously on the same file.

The Oracle database, which is one of the main direct I/O using applications, does not memory map the files to which it uses direct I/O and thus is unaffected. In addition, writing to a file that is memory mapped will succeed, as expected, unless there are page faults in flight at that point in time. The **mmap** system call on its own is safe when direct I/O is in use.

One of the following methods can be used to enable direct I/O on a file:

- **O_DIRECT**
- GFS file attribute
- GFS directory attribute

3.9.1. O_DIRECT

If an application uses the **O_DIRECT** flag on an **open()** system call, direct I/O is used for the opened file.

To cause the **O_DIRECT** flag to be defined with recent glibc libraries, define **_GNU_SOURCE** at the beginning of a source file before any includes, or define it on the **cc** line when compiling.

3.9.2. GFS File Attribute

The **gfs_tool** command can be used to assign (set) a direct I/O attribute flag, **directio**, to a GFS file. The **directio** flag can also be cleared.

You can use the **gfs_tool stat *filename*** to check what flags have been set for a GFS file. The output for this command includes a **Flags:** at the end of the display followed by a listing of the flags that are set for the indicated file.

Usage

Setting the directio Flag

```
gfs_tool setflag directio File
```

Clearing the directio Flag

```
gfs_tool clearflag directio File
```

File

Specifies the file where the **directio** flag is assigned.

Example

In this example, the command sets the **directio** flag on the file named **datafile** in directory **/mnt/gfs**.

```
gfs_tool setflag directio /mnt/gfs/datafile
```

The following command checks whether the **directio** flag is set for **/mnt/gfs/datafile**. The output has been elided to show only the relevant information.

```
[root@tng3-1 gfs]# gfs_tool stat /mnt/gfs/datafile
  mh_magic = 0x01161970
...

Flags:
  directio
```

3.9.3. GFS Directory Attribute

The **gfs_tool** command can be used to assign (set) a direct I/O attribute flag, **inherit_directio**, to a GFS directory. Enabling the **inherit_directio** flag on a directory causes all newly created regular files in that directory to automatically inherit the **directio** flag. Also, the **inherit_directio** flag is inherited by any new subdirectories created in the directory. The **inherit_directio** flag can also be cleared.

Usage

Setting the inherit_directio flag

```
gfs_tool setflag inherit_directio Directory
```

Clearing the inherit_directio flag

```
gfs_tool clearflag inherit_directio Directory
```

Directory

Specifies the directory where the **inherit_directio** flag is set.

Example

In this example, the command sets the **inherit_directio** flag on the directory named **/mnt/gfs/data**.

```
gfs_tool setflag inherit_directio /mnt/gfs/data
```

This command displays the flags that have been set for the **/mnt/gfs/data** directory. The full output has been truncated.

```
[root@tng3-1 gfs]# gfs_tool stat /mnt/gfs/data
...
Flags:
  inherit_directio
```

3.10. Data Journaling

Ordinarily, GFS writes only metadata to its journal. File contents are subsequently written to disk by the kernel's periodic sync that flushes file system buffers. An **fsync()** call on a file causes the file's data to be written to disk immediately. The call returns when the disk reports that all data is safely written.

Data journaling can result in a reduced **fsync()** time, especially for small files, because the file data is written to the journal in addition to the metadata. An **fsync()** returns as soon as the data is written to the journal, which can be substantially faster than the time it takes to write the file data to the main file system.

Applications that rely on **fsync()** to sync file data may see improved performance by using data journaling. Data journaling can be enabled automatically for any GFS files created in a flagged directory (and all its subdirectories). Existing files with zero length can also have data journaling turned on or off.

Using the **gfs_tool** command, data journaling is enabled on a directory (and all its subdirectories) or on a zero-length file by setting the **inherit_jdata** or **jdata** attribute flags to the directory or file, respectively. The directory and file attribute flags can also be cleared.

Usage

Setting and Clearing the inherit_jdata Flag

```
gfs_tool setflag inherit_jdata Directory
gfs_tool clearflag inherit_jdata Directory
```

Setting and Clearing the jdata Flag

```
gfs_tool setflag jdata File
gfs_tool clearflag jdata File
```

Directory

Specifies the directory where the flag is set or cleared.

File

Specifies the zero-length file where the flag is set or cleared.

Examples

This example shows setting the **inherit_jdata** flag on a directory. All files created in the directory or any of its subdirectories will have the **jdata** flag assigned automatically. Any data written to the files will be journaled. This example also shows the **gfs_tool stat** command you can use to verify what flags are set for a directory; the output has been elided to show only the relevant information.

```
[root@tng3-1]# gfs_tool setflag inherit_jdata /mnt/gfs/data
[root@tng3-1]# gfs_tool stat /mnt/gfs/data
...
Flags:
  inherit_jdata
```

This example shows setting the **jdata** flag on a file. The file must have a size of zero when you set this flag. Any data written to the file will be journaled. This example also shows the **gfs_tool stat** command you can use to verify what flags are set for a file; the output has been elided to show only the relevant information.

```
[root@tng3-1]# gfs_tool setflag jdata /mnt/gfs/datafile
[root@tng3-1]# gfs_tool stat /mnt/gfs/datafile
...
Flags:
  jdata
```

3.11. Configuring atime Updates

Each file inode and directory inode has three time stamps associated with it:

- **ctime** — The last time the inode status was changed
- **mtime** — The last time the file (or directory) data was modified
- **atime** — The last time the file (or directory) data was accessed

If **atime** updates are enabled as they are by default on GFS and other Linux file systems then every time a file is read, its inode needs to be updated.

Because few applications use the information provided by **atime**, those updates can require a significant amount of unnecessary write traffic and file-locking traffic. That traffic can degrade performance; therefore, it may be preferable to turn off **atime** updates.

Two methods of reducing the effects of **atime** updating are available:

- Mount with **noatime**
- Tune GFS **atime** quantum

3.11.1. Mount with noatime

A standard Linux mount option, **noatime**, can be specified when the file system is mounted, which disables **atime** updates on that file system.

Usage

```
mount BlockDevice MountPoint -o noatime
```

BlockDevice

Specifies the block device where the GFS file system resides.

MountPoint

Specifies the directory where the GFS file system should be mounted.

Example

In this example, the GFS file system resides on the **/dev/vg01/lvol0** and is mounted on directory **/gfs** with atime updates turned off.

```
mount /dev/vg01/lvol0 /gfs -o noatime
```

3.11.2. Tune GFS atime Quantum

When **atime** updates are enabled, GFS (by default) only updates them once an hour. The time quantum is a tunable parameter that can be adjusted using the **gfs_tool** command.

Each GFS node updates the access time based on the difference between its system time and the time recorded in the inode. It is required that system clocks of all GFS nodes in a cluster be synchronized. If a node's system time is out of synchronization by a significant fraction of the tunable parameter, **atime_quantum**, then **atime** updates are written more frequently. Increasing the frequency of **atime** updates may cause performance degradation in clusters with heavy work loads.

To see the current values of the GFS tunable parameters, including **atime_quantum**, you can use the **gfs_tool gettune**, as described in Section 3.5, “Displaying GFS Tunable Parameters”. The default value for **atime_quantum** is 3600 seconds.

The **gfs_tool settune** command is used to change the **atime_quantum** parameter value. It must be set on each node and each time the file system is mounted. The setting is not persistent across unmounts.

Usage

Changing the atime_quantum Parameter Value

```
gfs_tool settune MountPoint atime_quantum Seconds
```

MountPoint

Specifies the directory where the GFS file system is mounted.

Seconds

Specifies the update period in seconds.

Example

In this example, the **atime** update period is set to once a day (86,400 seconds) for the GFS file system on mount point **/gfs**.

```
gfs_tool settune /gfs atime_quantum 86400
```

3.12. Suspending Activity on a File System

You can suspend write activity to a file system by using the **gfs_tool freeze** command. Suspending write activity allows hardware-based device snapshots to be used to capture the file system in a consistent state. The **gfs_tool unfreeze** command ends the suspension.

Usage

Start Suspension

```
gfs_tool freeze MountPoint
```

End Suspension

```
gfs_tool unfreeze MountPoint
```

MountPoint

Specifies the file system.

Examples

This example suspends writes to file system **/gfs**.

```
gfs_tool freeze /gfs
```

This example ends suspension of writes to file system **/gfs**.

```
gfs_tool unfreeze /gfs
```

3.13. Displaying Extended GFS Information and Statistics

You can use the **gfs_tool** command to gather a variety of details about GFS. This section describes typical use of the **gfs_tool** command for displaying space usage, statistics, and extended status.

The **gfs_tool** command provides additional action flags (options) not listed in this section. For more information about other **gfs_tool** flags, refer to the **gfs_tool** man page.

3.13.1. Displaying GFS Space Usage

You can use the **df** flag of the **gfs_tool** to display a space-usage summary of a given file system. The information is more detailed than a standard **df**.

Usage

```
gfs_tool df MountPoint
```

MountPoint

Specifies the file system to which the action applies.

Example

This example reports extended file system usage about file system **/mnt/gfs**.

```
[root@ask-07 ~]# gfs_tool df /mnt/gfs
/gfs:
  SB lock proto = "lock_dlm"
  SB lock table = "ask_cluster:mydata1"
  SB ondisk format = 1309
  SB multihost format = 1401
  Block size = 4096
  Journals = 8
  Resource Groups = 605
  Mounted lock proto = "lock_dlm"
  Mounted lock table = "ask_cluster:mydata1"
  Mounted host data = "jid=0:id=786433:first=1"
  Journal number = 0
  Lock module flags = 0
  Local flocks = FALSE
  Local caching = FALSE
  Oopses OK = FALSE

  Type           Total          Used           Free           use%
  ------------------------------------------------------------------------
  inodes         5              5              0              100%
  metadata       78             15             63             19%
  data           41924125       0              41924125       0%
```

3.13.2. Displaying GFS Counters

You can use the **counters** flag of the **gfs_tool** to display statistics about a file system. If the **-c** option is used, the **gfs_tool** command continues to run, displaying statistics once per second.

Note

The majority of the GFS counters reflect the internal operation of the GFS file system and are for development purposes only.

The **gfs_tool counters** command displays the following statistics.

locks

The number of **gfs_glock** structures that currently exist in gfs.

locks held

The number of existing **gfs_glock** structures that are not in the **UNLOCKED** state.

freeze count

A freeze count greater than 0 means the file system is frozen. A freeze count of 0 means the file system is not frozen. Each **gfs_tool freeze** command increments this count. Each **gfs_tool unfreeze** command decrements this count.

incore inodes

The number of **gfs_inode** structures that currently exist in gfs.

metadata buffers

The number of **gfs_bufdata** structures that currently exist in gfs.

unlinked inodes

The **gfs_inoded** daemon links deleted inodes to a global list and cleans them up every 15 seconds (a period that is tunable). This number is the list length. It is related to the number of **gfs_unlinked** structures currently in gfs.

quota IDs

The number of **gfs_quota_data** structures that currently exist in gfs.

incore log buffers

The number of buffers in in-memory journal log (incore log), before they are flushed to disk.

log space used

The the percentage of journal space used.

meta header cache entries

The number of **gfs_meta_header_cache** structures that currently exist in gfs.

glock dependencies

The number of **gfs_depend structures** that currently exist in gfs.

glocks on reclaim list

The number of glocks on the reclaim list.

log wraps

The number of times journal has wrapped around.

outstanding LM calls

obsolete

outstanding BIO calls

obsolete

fh2dentry misses

The number of times an NFS call could not find a **dentry** structure in the cache.

glocks reclaimed

The number of glocks which have been reclaimed.

glock dq calls

The number of glocks released since the file system was mounted.

glock prefetch calls

The number of glock prefetch calls.

lm_lock calls

The number of times the lock manager has been contacted to obtain a lock.

lm_unlock calls

The number of times the lock manager has been contacted to release a lock.

lm callbacks

The number of times the lock manager has been contacted to change a lock state.

address operations

The number of address space call operations (**readpage**, **writepage**, **directIO**, **prepare_write**, and **commit_write**)

dentry operations

The number of times a seek operation has been performed on the vfs **dentry** structure.

export operations

The number of times a seek operation has been performed on the nfs **dentry** structure.

file operations

The number of file operations that have been invoked (read, write, seek, etc).

inode operations

The number of inode operations that have been invoked (create, delete, symlink, etc.).

super operations

The number of super block operations.

vm operations

The number of times the **mmap** function has been called. mmap call count

block I/O reads

obsolete

block I/O writes

obsolete

Usage

```
gfs_tool counters MountPoint
```

MountPoint

Specifies the file system to which the action applies.

Example

This example reports statistics about the file system mounted at **/mnt/gfs**.

```
[root@tng3-1 gfs]# gfs_tool counters /mnt/gfs

                                  locks 165
                             locks held 133
                           freeze count 0
                          incore inodes 34
                       metadata buffers 5
                        unlinked inodes 0
                              quota IDs 0
                      incore log buffers 0
                          log space used 0.05%
               meta header cache entries 5
                      glock dependencies 5
                  glocks on reclaim list 0
                              log wraps 0
                    outstanding LM calls 0
                   outstanding BIO calls 0
                        fh2dentry misses 0
                        glocks reclaimed 345
                          glock nq calls 11632
                          glock dq calls 11596
                    glock prefetch calls 84
                           lm_lock calls 545
                         lm_unlock calls 237
                            lm callbacks 782
                      address operations 1075
                       dentry operations 374
                       export operations 0
                         file operations 1428
                        inode operations 1451
                        super operations 21239
                           vm operations 0
                        block I/O reads 0
                       block I/O writes 0
```

3.13.3. Displaying Extended Status

You can use the **stat** flag of the **gfs_tool** to display extended status information about a GFS file.

Note

The information that the **gfs_tool stat** command displays reflects internal file system information. This information is intended for development purposes only.

Usage

```
gfs_tool stat File
```

File

Specifies the file from which to get information.

Example

This example reports extended file status about file **/gfs/datafile**.

```
[root@tng3-1 gfs]# gfs_tool stat /gfs/datafile
  mh_magic = 0x01161970
  mh_type = 4
  mh_generation = 3
  mh_format = 400
  mh_incarn = 1
  no_formal_ino = 66
  no_addr = 66
  di_mode = 0600
  di_uid = 0
  di_gid = 0
  di_nlink = 1
  di_size = 503156
  di_blocks = 124
  di_atime = 1207672023
  di_mtime = 1207672023
  di_ctime = 1207672023
  di_major = 0
  di_minor = 0
  di_rgrp = 17
  di_goal_rgrp = 17
  di_goal_dblk = 371
  di_goal_mblk = 44
  di_flags = 0x00000000
  di_payload_format = 0
  di_type = 1
  di_height = 1
  di_incarn = 0
  di_pad = 0
  di_depth = 0
  di_entries = 0
  no_formal_ino = 0
  no_addr = 0
  di_eattr = 0
  di_reserved =
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
```

3.14. Repairing a File System

When nodes fail with the file system mounted, file system journaling allows fast recovery. However, if a storage device loses power or is physically disconnected, file system corruption may occur. (Journaling cannot be used to recover from storage subsystem failures.) When that type of corruption occurs, you can recover the GFS file system by using the **gfs_fsck** command.

Important

The **gfs_fsck** command must be run only on a file system that is unmounted from all nodes.

Important

You should not check a GFS file system at boot time with the **gfs_fsck** command. The **gfs_fsck** command can not determine at boot time whether the file system is mounted by another node in the cluster. You should run the **gfs_fsck** command manually only after the system boots.

To ensure that the **gfs_fsck** command does not run on a GFS file system at boot time, modify the **/etc/fstab** file so that the final two columns for a GFS file system mount point show "0 0" rather than "1 1" (or any other numbers), as in the following example:

```
/dev/VG12/lv_svr_home /svr_home gfs defaults,noatime,nodiratime,noquota 0 0
```

Note

The **gfs_fsck** command has changed from previous releases of Red Hat GFS in the following ways:

- Pressing **Ctrl**+**C** while running the **gfs_fsck** interrupts processing and displays a prompt asking whether you would like to abort the command, skip the rest of the current pass, or continue processing.
- You can increase the level of verbosity by using the **-v** flag. Adding a second **-v** flag increases the level again.
- You can decrease the level of verbosity by using the **-q** flag. Adding a second **-q** flag decreases the level again.
- The **-n** option opens a file system as read-only and answers **no** to any queries automatically. The option provides a way of trying the command to reveal errors without actually allowing the **gfs_fsck** command to take effect.

Refer to the **gfs_fsck** man page, **gfs_fsck(8)**, for additional information about other command options.

Running the **gfs_fsck** command requires system memory above and beyond the memory used for the operating system and kernel. Each block of memory in the file system itself requires approximately one byte of additional memory. So to estimate the amount of memory you will need to run the **gfs_fsck** command on your file system, divide the file system size (in bytes) by the block size.

For example, for a GFS file system that is 16TB with a block size of 4K, divide 16TB by 4K:

```
17592186044416 / 4096 = 4294967296
```

This file system requires approximately 4GB of free memory to run the **gfs_fsck** command. Note that if the block size was 1K, running the **gfs_fsck** command would require four times the memory, or 16GB.

Usage

```
gfs_fsck -y BlockDevice
```

-y

The **-y** flag causes all questions to be answered with **yes**. With the **-y** flag specified, the **gfs_fsck** command does not prompt you for an answer before making changes.

BlockDevice

Specifies the block device where the GFS file system resides.

Example

In this example, the GFS file system residing on block device **/dev/gfsvg/gfslv** is repaired. All queries to repair are automatically answered with **yes**. Because this example uses the **-v** (verbose) option, the sample output is extensive and repetitive lines have been elided.

```
[root@tng3-1]# gfs_fsck -v -y /dev/gfsvg/gfslv
Initializing fsck
Initializing lists...
Initializing special inodes...
Validating Resource Group index.
Level 1 check.
92 resource groups found.
(passed)
Setting block ranges...
Creating a block list of size 9175040...
Clearing journals (this may take a while)Clearing journal 0
Clearing journal 1
Clearing journal 2
...
Clearing journal 10

Journals cleared.
Starting pass1
Checking metadata in Resource Group 0
Checking metadata in Resource Group 1
...
Checking metadata in Resource Group 91
Pass1 complete
Starting pass1b
Looking for duplicate blocks...
No duplicate blocks found
Pass1b complete
Starting pass1c
Looking for inodes containing ea blocks...
Pass1c complete
Starting pass2
Checking directory inodes.
Pass2 complete
Starting pass3
Marking root inode connected
Checking directory linkage.
Pass3 complete
Starting pass4
Checking inode reference counts.
Pass4 complete
Starting pass5
...
Updating Resource Group 92
```

```
Pass5 complete
Writing changes to disk
Syncing the device.
Freeing buffers.
```

3.15. Context-Dependent Path Names

Context-Dependent Path Names (CDPNs) allow symbolic links to be created that point to variable destination files or directories. The variables are resolved to real files or directories each time an application follows the link. The resolved value of the link depends on the node or user following the link.

CDPN variables can be used in any path name, not just with symbolic links. However, the CDPN variable name cannot be combined with other characters to form an actual directory or file name. The CDPN variable must be used alone as one segment of a complete path.

Usage

For a Normal Symbolic Link

```
ln -s Target LinkName
```

Target

Specifies an existing file or directory on a file system.

LinkName

Specifies a name to represent the real file or directory on the other end of the link.

For a Variable Symbolic Link

```
ln -s Variable LinkName
```

Variable

Specifies a special reserved name from a list of values (refer to Table 3.5, “CDPN ***Variable*** Values”) to represent one of multiple existing files or directories. This string is not the name of an actual file or directory itself. (The real files or directories must be created in a separate step using names that correlate with the type of variable used.)

LinkName

Specifies a name that will be seen and used by applications and will be followed to get to one of the multiple real files or directories. When ***LinkName*** is followed, the destination depends on the type of variable and the node or user doing the following.

Table 3.5. CDPN *Variable* Values

Variable	Description
@hostname	This variable resolves to a real file or directory named with the hostname string produced by the output of the following command: **echo `uname -n`**

Variable	Description
@mach	This variable resolves to a real file or directory name with the machine-type string produced by the output of the following command: **echo `uname -m`**
@os	This variable resolves to a real file or directory named with the operating-system name string produced by the output of the following command: **echo `uname -s`**
@sys	This variable resolves to a real file or directory named with the combined machine type and OS release strings produced by the output of the following command: **echo `uname -m`_`uname -s`**
@uid	This variable resolves to a real file or directory named with the user ID string produced by the output of the following command: **echo `id -u`**
@gid	This variable resolves to a real file or directory named with the group ID string produced by the output of the following command: **echo `id -g`**

Example

In this example, there are three nodes with hostnames **n01**, **n02** and **n03**. Applications on each node uses directory **/gfs/log/**, but the administrator wants these directories to be separate for each node. To do this, no actual log directory is created; instead, an **@hostname** CDPN link is created with the name **log**. Individual directories **/gfs/n01/**, **/gfs/n02/**, and **/gfs/n03/** are created that will be the actual directories used when each node references **/gfs/log/**.

```
n01# cd /gfs
n01# mkdir n01 n02 n03
n01# ln -s @hostname log

n01# ls -l /gfs
lrwxrwxrwx 1 root root 9 Apr 25 14:04 log -> @hostname/
drwxr-xr-x 2 root root 3864 Apr 25 14:05 n01/
drwxr-xr-x 2 root root 3864 Apr 25 14:06 n02/
drwxr-xr-x 2 root root 3864 Apr 25 14:06 n03/

n01# touch /gfs/log/fileA
n02# touch /gfs/log/fileB
n03# touch /gfs/log/fileC

n01# ls /gfs/log/
fileA
n02# ls /gfs/log/
fileB
n03# ls /gfs/log/
fileC
```

3.16. The GFS Withdraw Function

The GFS *withdraw* function is a data integrity feature of GFS file systems in a cluster. If the GFS kernel module detects an inconsistency in a GFS file system following an I/O operation, the file system becomes unavailable to the cluster. The I/O operation stops and the system waits for further I/O operations to stop with an error, preventing further damage. When this occurs, you can stop any

other services or applications manually, after which you can reboot and remount the GFS file system to replay the journals. If the problem persists, you can unmount the file system from all nodes in the cluster and perform file system recovery with the **gfs_fsck** command. The GFS withdraw function is less severe than a kernel panic, which would cause another node to fence the node.

An example of an inconsistency that would yield a GFS withdraw is an incorrect block count. When the GFS kernel module deletes a file from a file system, it systematically removes all the data and metadata blocks associated with that file. When it is done, it checks the block count. If the block count is not one (meaning all that is left is the disk inode itself), that indicates a file system inconsistency since the block count did not match the list of blocks found.

You can override the GFS withdraw function by mounting the file system with the **-o errors=panic** option specified. When this option is specified, any errors that would normally cause the system to withdraw cause the system to panic instead. This stops the node's cluster communications, which causes the node to be fenced.

Internally, the GFS2 withdraw function works by having the kernel send a message to the **gfs_controld** daemon requesting withdraw. The **gfs_controld** daemon runs the **dmsetup** program to place the device mapper error target underneath the filesystem preventing further access to the block device. It then tells the kernel that this has been completed. This is the reason for the GFS2 support requirement to always use a CLVM device under GFS2, since otherwise it is not possible to insert a device mapper target.

The purpose of the device mapper error target is to ensure that all future I/O operations will result in an I/O error that will allow the filesystem to be unmounted in an orderly fashion. As a result, when the withdraw occurs, it is normal to see a number of I/O errors from the device mapper device reported in the system logs.

Occasionally, the withdraw may fail if it is not possible for the **dmsetup** program to insert the error target as requested. This can happen if there is a shortage of memory at the point of the withdraw and memory cannot be reclaimed due to the problem that triggered the withdraw in the first place.

A withdraw does not always mean that there is an error in GFS2. Sometimes the withdraw function can be triggered by device I/O errors relating to the underlying block device. It is highly recommended to check the logs to see if that is the case if a withdraw occurs.

Revision History

Revision 8.0-6 **Mon Sep 8 2014** **Steven Levine**
Version for 5.11 GA release

Revision 8.0-4 **Mon Jun 30 2014** **Steven Levine**
Beta release of Red Hat Enterprise Linux 5.11

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Revision 7.0-1 **Mon May 6 2013** **Steven Levine**
Test printing for new Publican

Revision 6.1-1 **Fri Jan 4 2013** **Steven Levine**
Version for Red Hat Enterprise Linux 5.9 GA release

Revision 6.1-0 **Wed Aug 29 2012** **Steven Levine**
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Revision 6.0-3 **Mon Feb 20 2012** **Steven Levine**
Release for GA of Red Hat Enterprise Linux 5.8

Revision 6.0-2 **Thu Dec 15 2011** **Steven Levine**
Beta release of Red Hat Enterprise Linux 5.8

Revision 6.0-1 **Thu Nov 10 2011** **Steven Levine**
Resolves: #758843
Notes CLVM requirement for clustered environment.

Resolves: #736157
Adds note warning not to check a GFS file system at boot time.

Revision 5.0-1 **Thu Jul 21 2011** **Steven Levine**
Resolves: #458880
Adds note about using file locking to ensure that memory mapped and direct I/O do not occur simultaneously on the same file.

Resolves: #676133
Clarifies section on the withdraw function.

Revision 4.0-1 **Thu Dec 23 2010** **Steven Levine**
Resolves: #661520
Updates information about maximum file system size.

Resolves: #667552
Adds note to overview about issuing operations on one directory from more than one node at the same time.

Revision 3.0-2	Tue Aug 3 2010	Steven Levine

Resolves: #562251
Adds information about the **`localflocks`** mount option and when it may be required.

Revision 3.0-1	Thu Mar 18 2010	Steven Levine

Resolves: #568179
Adds note clarifying support policy for single-node system.

Resolves: #562199
Adds note clarifying 16-node limitation.

Resolves: #515348
Documents new -o errors mount option.

Resolves: #573750
Documents memory requirements for gfs_fsck.

Resolves: #574462
Clarifies issue of gfs requiring CLVM for Red Hat support.

Revision 2.0-1	Tue Aug 18 2009	Steven Levine

Resolves: #515807
Adds note clarifying that you cannot reduce the size of an existing file system.

Resolves: #480002
Adds caveat about unmounting a file system manually if you mounted it manually.

Resolves: #458604
Adds section on GFS withdraw function.

Revision 1.0-1	Thu Jan 29 2009	

Index

A

adding journals to a file system, Adding Journals to a File System

atime, configuring updates, Configuring atime Updates
- mounting with noatime , Mount with noatime
- tuning atime quantum, Tune GFS atime Quantum

audience, Audience

C

CDPN variable values table, Usage

configuration, before, Before Setting Up GFS

configuration, initial, Getting Started
- prerequisite tasks, Prerequisite Tasks

creating a file system, Creating a File System

D

data journaling, Data Journaling

direct I/O, Direct I/O
- directory attribute, GFS Directory Attribute
- file attribute, GFS File Attribute
- O_DIRECT , O_DIRECT

displaying extended GFS information and statistics, Displaying Extended GFS Information and Statistics

displaying GFS counters, Displaying GFS Counters

displaying GFS extended status, Displaying Extended Status

displaying GFS space usage, Displaying GFS Space Usage

DLM (Distributed Lock Manager), New and Changed Features

F

features, new and changed, New and Changed Features

feedback, Feedback

file system
- adding journals, Adding Journals to a File System
- atime, configuring updates, Configuring atime Updates
  - mounting with noatime , Mount with noatime
  - tuning atime quantum, Tune GFS atime Quantum
- context-dependent path names (CDPNs), Context-Dependent Path Names
- creating, Creating a File System
- data journaling, Data Journaling
- direct I/O, Direct I/O
  - directory attribute, GFS Directory Attribute
  - file attribute, GFS File Attribute
  - O_DIRECT , O_DIRECT
- growing, Growing a File System
- mounting, Mounting a File System, Special Considerations when Mounting GFS File Systems
- quota management, GFS Quota Management
  - disabling/enabling quota accounting, Disabling/Enabling Quota Accounting
  - disabling/enabling quota enforcement, Disabling/Enabling Quota Enforcement
  - displaying quota limits, Displaying Quota Limits and Usage
  - setting quotas, Setting Quotas
  - synchronizing quotas, Synchronizing Quotas
- repairing, Repairing a File System
- suspending activity, Suspending Activity on a File System
- unmounting, Unmounting a File System, Special Considerations when Mounting GFS File Systems

G

GFS
- atime, configuring updates, Configuring atime Updates
  - mounting with noatime , Mount with noatime
  - tuning atime quantum, Tune GFS atime Quantum

- direct I/O, Direct I/O
  - directory attribute, GFS Directory Attribute
  - file attribute, GFS File Attribute
  - O_DIRECT , O_DIRECT
- displaying counters, Displaying GFS Counters
- displaying extended information and statistics, Displaying Extended GFS Information and Statistics
- displaying extended status, Displaying Extended Status
- displaying space usage, Displaying GFS Space Usage
- managing, Managing GFS
- quota management, GFS Quota Management
  - disabling/enabling quota accounting, Disabling/Enabling Quota Accounting
  - disabling/enabling quota enforcement, Disabling/Enabling Quota Enforcement
  - displaying quota limits, Displaying Quota Limits and Usage
  - setting quotas, Setting Quotas
  - synchronizing quotas, Synchronizing Quotas
- withdraw function, The GFS Withdraw Function

GFS file system maximum size, GFS Overview, Before Setting Up GFS

GFS software components, GFS Software Components

GFS software components table, GFS Software Components

GFS-specific options for adding journals table, Complete Usage

GFS-specific options for expanding file systems table, Complete Usage

gfs_mkfs command options table, Complete Options

growing a file system, Growing a File System

GULM (Grand Unified Lock Manager), New and Changed Features

I

initial tasks
- setup, initial, Initial Setup Tasks

introduction, Introduction
- audience, Audience

M

managing GFS, Managing GFS

maximum size, GFS file system, GFS Overview, Before Setting Up GFS

mount table, Complete Usage

mounting a file system, Mounting a File System, Special Considerations when Mounting GFS File Systems

O

overview, GFS Overview
- configuration, before, Before Setting Up GFS
- economy, Performance, Scalability, and Economy
- features, new and changed, New and Changed Features
- GFS software components, GFS Software Components
- performance, Performance, Scalability, and Economy

- scalability, Performance, Scalability, and Economy

P

parameters, GFS tunable, Displaying GFS Tunable Parameters

path names, context-dependent (CDPNs), Context-Dependent Path Names

preface (see introduction)

prerequisite tasks
- configuration, initial, Prerequisite Tasks

Q

quota management, GFS Quota Management
- disabling/enabling quota accounting, Disabling/Enabling Quota Accounting
- disabling/enabling quota enforcement, Disabling/Enabling Quota Enforcement
- displaying quota limits, Displaying Quota Limits and Usage
- setting quotas, Setting Quotas
- synchronizing quotas, Synchronizing Quotas

R

repairing a file system, Repairing a File System

S

setup, initial
- initial tasks, Initial Setup Tasks

suspending activity on a file system, Suspending Activity on a File System

system hang at unmount, Special Considerations when Mounting GFS File Systems

T

tables
- CDPN variable values, Usage
- GFS software components, GFS Software Components
- GFS-specific options for adding journals, Complete Usage
- GFS-specific options for expanding file systems, Complete Usage
- gfs_mkfs command options, Complete Options
- mount options, Complete Usage

tunable parameters, GFS, Displaying GFS Tunable Parameters

U

unmount, system hang, Special Considerations when Mounting GFS File Systems

unmounting a file system, Unmounting a File System, Special Considerations when Mounting GFS File Systems

W

withdraw function, GFS, The GFS Withdraw Function